CLAIMS

I Claim:

1. A duplexer comprising:

an input/output line;

a transmit segment; connected to the input/output line; and,

a receive segment, the receive segment including:

a balun including:

a first output,

a second output,

a first transmission line coupled between the input/output line and the first output, and

a second transmission line coupled between the input/output line and the second output, and

a differential filter connected to the first output and the second output, the differential filter including resonator elements connected so that at transmit band frequencies of the duplexer, the first output and the second output are shorted.

2. A duplexer as in claim 1 wherein at transmit band frequencies of the duplexer, the first output and the second output are each shorted to a reference voltage.

3. A duplexer as in claim 1 wherein at transmit band frequencies of the duplexer, the first output and the second output are shorted to each other.

4. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in a paired half ladder structure.

5. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in a full ladder structure.

6. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in a lattice structure.

7. A duplexer as in claim 1 wherein the resonator elements are arranged so that the differential filter includes resonator elements arranged in both a paired half ladder structure and a full ladder structure.

8. A duplexer as in claim 1 wherein a length of the first transmission line is chosen to cause a phase delay of approximately one fourth wave length at receive band frequencies of the duplexer, and a length of the second transmission line is chosen to cause a phase delay of approximately three fourths wave length at the receive band frequencies of the duplexer.

9. A duplexer as in claim 1 wherein the transmit segment includes a single ended filter including resonator elements connected so that at receive

band frequencies of the duplexer, an open circuit is presented by the single ended filter to the input/output line.

10. A duplexer as in claim 1 wherein the resonator elements are each implemented as a film bulk acoustic resonator (FBAR).

11. A method for providing filtering within a duplexer, the method comprising the following steps:

(a) for signals at the transmit band frequencies, performing the following substeps:

(a.1) providing passband transmission through a single-ended filter of the duplexer, and

(a.2) providing a short circuit at a first input and second input of a differential filter, the first input of the differential filter being connected to an input/output line of the duplexer via a balun and the second input of the differential filter being connected to the input/output line of the duplexer via the balun; and,

(b) for signals at the receive band frequencies, performing the following substep:

(b.1) providing passband transmission through the differential filter of the duplexer.

12. A method as in claim 11 wherein substep (a.2) includes at transmit band frequencies of the duplexer, shorting the first output and the second output to a reference voltage.

13. A method as in claim 11 wherein substep (a.2) includes at transmit band frequencies of the duplexer, shorting the first output and the second output to each other.

14. A method as in claim 11 wherein step (b) additionally includes the following substeps performed for signals at the receive band frequencies:

(b.2) providing a phase delay of approximately one fourth wave length through a first transmission line within the balun, and

(b.3) providing a phase delay of approximately three fourths wave length through a second transmission line within the balun, and

15. A method as in claim 11 wherein step (b) additionally includes the following substep performed for signals at the receive band frequencies:

(b.2) providing an open circuit by the single-ended filter to the input/output line.

16. A duplexer comprising:

an input/output line;

a transmit segment; connected to the input/output line; and,

a receive segment, the receive segment including:

a balun connected to the input/output line, the balun including:

a first output, and

a second output, and

a differential filter connected to the first output and the second output, the differential filter shorting the first output and the second output at transmit band frequencies of the duplexer.

17. A duplexer as in claim 16 wherein at transmit band frequencies of the duplexer, the first output and the second output are each shorted to a reference voltage.

18. A duplexer as in claim 16 wherein at transmit band frequencies of the duplexer, the first output and the second output are shorted to each other.

19. A duplexer as in claim 16 wherein the transmit segment includes a single-ended filter wherein at receive band frequencies of the duplexer, an open circuit is presented by the single-ended filter to the input/output line.

20. A duplexer as in claim 16 wherein the balun additionally includes:

a first transmission line coupled between the input/output line and the first output; and,

a second transmission line coupled between the input/output line and the second output; and,

21. A duplexer as in claim 16 wherein the balun additionally includes:

a first transmission line coupled between the input/output line and the first output, a length of the first transmission line is chosen to cause a phase delay of approximately one fourth wave length at receive band frequencies of the duplexer; and,

a second transmission line coupled between the input/output line and the second output, a length of the second transmission line is chosen to cause a phase delay of approximately three fourths wave length at the receive band frequencies of the duplexer.

22. A duplexer as in claim 16 wherein the differential filter includes resonator elements connected so that at transmit band frequencies of the duplexer, the first output and the second output are shorted.